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In the longer run, consumer prices for broccoli could return toward current levels if new, low cost weed control methods are developed.

However, current information suggests that this development is doubtful. It is very likely that increased weed pressures over time would cause yield reductions, which would likely result in retail price increases of undetermined magnitude.

Social/Community Impact

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Although data limitations prevent an in-depth evaluation of the social and community impacts of prohibiting the use of nitrofen, a few potential impacts may be noted:

- Additional hoeing operations and mechanical cultivations
 required by alternative weed control programs would increase the
 seasonal demand for field labor and possibly bid up current
 wages. In some areas there could be seasonal shortages of field
 labor.
- 2. The use of alternative weed control programs or the reallocation of land to other crops could lead to an increased demand for new farm equipment and other factors of production.
- 3. The potential long-term reductions in broccoli production could cause some local processors to operate at a less than optimum level of output. In some cases, processors might need to search out new, and more distant supply outlets for broccoli or reinvest in new machinery capable of processing alternative crops.

Limitations of Analysis

- 1. There are insufficient biological and economic data for long run estimates of potential crop shifts following a possible regulatory action on nitrofen.
- 2. This analysis assumed the availability of labor for additional hoeing operations and mechnical cultivations required by alternative weed control programs used on broccoli.
- 3. The price of field labor is assumed to remain constant in the short run, at \$7.50 per hour.

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Par Acre Cost of Preemergent Nitrofen Weed Control Programs Used on Broccoli in California Table 1.

Veed Control Program <u>a</u> /	Application Rate (lbs. 3.1.)	Cost per 1b. a.t. (\$) b/	Herbfelde Treatment Cost per Acre (\$) c/	Cultivation Costs per Acre (\$) e/	Hoeing Costs f/	Total Weed Control Cost per Acre (\$)
nitrofen pre.	7	7.42	22.84	21.00	52.50	96.34
altrofen + CDEC pre.	1	7.42 + 6.63	36.10	21.00	52.50	109.60
altrofen + DCPA pre.	2 + 4.5	7.42 + 6.72	53.08	21.00	52.50	126.58
trifluralin pre-inc. + nitrofen pre.	0.5	12.60	23.30 <u>d/</u> 22.84 46.14	21.00	52.50	119.64
nitrofen pre. + DCPA post.	4.5	7.42 6.72	22.84 38.24 61.08	21.00	52.50	134.58
altrofen pre.	2	7.42	, 22.84	21.00	1	43.84

Control programs and application rates were developed by the Nitrofen Assessment Team. Assumes band herbicide treatments. Pre = preplant application; Pre-inc. = preplant soil incorporation; post. = postplant application.

Based on 1981 pesticide prices reported in Galt et al., 1981, p. vii. Mitrofen cost based on 1980 price.

Includes herbicide application cost at \$8.00 per acre for all treatments except as noted.

Includes pre-plant soil incorporation cost of \$17.00 per acre.

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Three cultivations at \$7.00/acre/cultivation.

Assessment Team specified Noting requirements as Indicated.

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Table 2. Total Cost of Nitrofen Weed Control Programs Used on Broccoli in California

Weed Control Program a/	Cost per Acre (\$) <u>b</u> /	Number of Acres Treated <u>c</u> /	Total Cost (\$)
nitrofen preemergence	96.34	36,285	3,496,000
nitrofen + CIEC preemergence tank-mix	109.60	3,557	390,000
nitrofen + LXPA preemergence tank-mix	126.58	1,423	180,000
trifluralin preplant incorporated plus nitrofen preenergence	119.64	712	85,000
nitrofen preemergence + DCPA postemergence	134.58	712	%,000
nitrofen preemergence (no hoeing)	43.84	28,459	1,248,000
		71,148	5,495,000

 $[\]frac{a}{b}$ Programs specified by the Nitrofen Assessment Team $\frac{b}{c}$ Derived in Table 1. Extent of use of each program specified by the Nitr

Extent of use of each program specified by the Nitrofen Assessment Team.

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Per Acre Costs of Alternative Weed Control Programs on Broccolf in California Table 3.

Total Weed Control Cost per Acre	50 182.00	177.50		18	190.49	160.39	203.62	197.75
Hoeing Costs <u>f</u> / Inning Weeding	52.50	52.50		52.50	52.50	52.50	65.63	68.25
Hoeing Thinning	105.00	52.50		52.50	78.75	65.63	78.75	105.00
Cultivation Costs per Acre (\$) e/	24.50	21.00		21.00		21.00	21.00	24.50
Herbicide Treatment Cost per Acre (\$) <u>c/</u>	1	51.50	23.30 <u>d/</u>	38.24	E 1	21.26	38.24	1
Cost per 1b.	1	6.63 + 6.72	12.60	6.72	6.72	6,63	6.72	1
Application Rate (lbs. a.1.)		2 + 4.5	0.5	4.5	4.5	2	4.5	1
Weed Control Program <u>a/</u>	cultural controls #1	CDEC + DCPA pre. tank mix	trifluralin - pre.	+ DCPA - pre.	PA pre. #1	CDEC pre-	DCPA pre. #2	cultural controls /2

Control programs and application rates were developed by the Nitrofen Assessment Team. Assumes band herbicide treatments. Pre. * preplant

application; pre-inc. * preplant soil incorporation; post. * postplant application.
Based on 1981 pesticide prices reported in Galt et al., 1981, p. vii. Nitrofen cost based on 1980 price.
Includes herbicide application cost of \$8.00 per acre for all treatments except as noted. البارة المارات

Includes one cultivation at \$10.50 per acre plus two at \$7.00 per acre or three cultivations at \$7.00 per acre. Includes pre-plant soil incorporation cost at \$17.00 per acre.

Assessment Team specified the amounts of plant thinning and weed hoeing required under the various programs.

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Table 4. Total Cost of Alternative Weed Control Programs Used on Broccoli in California - CDEC Available

Weed Control Program a/	Cost per Acre (\$) <u>b</u> /	Number of Acres Treated <u>c/</u>	Total Cost (\$)
cultural controls #1	182.00	21,131	3,846,000
CDEC + DCPA preemergence tank mix	177.50	29,455	5,228,000
trifluralin preemergence soil incorporation + DCPA preemergence	187.54	5,834	1,094,000
ICPA preemergence #1	190.49	13,803	2,629,000
CDEC preemergence	160.39	925	148,000
		71,148	12,945,000

 $[\]begin{array}{c} \underline{a}/\\ \underline{b}/\\ \underline{c}/\\ \end{array} \begin{array}{c} \text{Programs specified by the Nitrofen Assessment Team.} \\ \\ \underline{c}/\\ \end{array} \\ \text{Extent of use of each program specified by the Nitrofen Assessment Team.} \\ \end{array}$

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Table 5. Total Cost of Alternative Weed Control Programs Used on Broccoli in California - CDEC Unavailable

Cost per Acre (\$) <u>b</u> /	Number of Acres Treated <u>c</u> /	Total Cost (\$)
182.00	21,131	3,846,000
203.62	29,455	5,998,000
187.54	5,834	1,094,000
190.49	13,803	2,629,000
197.75	925	183,000
	71,148	13,750,000
	182.00 203.62 187.54 190.49	182.00 21,131 203.62 29,455 187.54 5,834 190.49 13,803 197.75 925

 $[\]frac{a}{b}$ Programs specified by the Nitrofen Assessment Team.

Derived in Table 3.

Extent of use of each program specified by the Nitrofen Assessment Team.

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SUMMARY OF PRELIMINARY BENEFIT ANALYSIS OF PREEMERGENT NITROFEN USE ON BRUSSELS SPROUTS

USE:

Nitrofen use on Brussels Sprouts.

B. MAJOR PESTS CONTROLLED:

annual bluegrass lambsquarters

crabgrass goosefoot

malva pigweed nightshade purslane shepherdspurse spergularia

C. ALTERNATIVES:

Major registered chemicals:

CDEC, DCPA, Trifluralin

Comparative efficacy/performance:

Use of alternative weed control methods would maintain current yields and quality i the short run. In the longer run, yields may decline due to anticipated buildup

nettle

of weed populations.

Comparative costs:

N/A

D. EXTENT OF USE:

User:

None. The Assessment Team projected little or no nitrofen use under the program

proposed by Rohm and Haas.

E. ECONOMIC IMPACTS:

None

Market/Consumer:

None

Macroeconomic:

None

F. SOCIAL/COMMUNITY IMPACTS:

None

G. LIMITATIONS OF ANALYSIS:

Estimates of comparative efficacy of nitrofen and alternative herbicides were based

Robert F. Torla

Pest Control Branch

Economic Research Service

U.S. Department of Agriculture

Natural Resource Economics Division

on the experience of weed science specialists and not on field data.

There are insufficient biological and economic data to assess potential long run

impacts of increasing weed pressure following a nitrofen suspension.

PRINCIPAL ANALYST AND DATE:

Harold W. Gaede

Economic Analysis Branch

Benefits and Field Studies Division

Office of Pesticide Programs

U.S. Environmental Protection Agency

July 1981

Current Use Analysis

EPA Registration of Nitrofen and Alternativies

Nitrofen is a selective herbicide registered for use on brussels sprouts to control the following weeds: annual bluegrass, crabgrass, goosefoot, lambsquarters, malva, nightshade, nettle, pigweed, purslane, shepherdspurse, and spergularia (EPA, 1980). Nitrofen, prior to the voluntary market removal, was applied to brussels sprouts at postemergence, usually in sequence with a preplant incorporation of trifluralin or CDEC and a preemergent application of DCPA (USDA/EPA/States, 1980). Although available in a emulsifiable concentrate formulation (25EC), nitrofen was usually applied to brussels sprouts in a wettable powder formulation (50 WP). The label directions for nitrofen use in the wettable powder formulation called for a single postermergence application at 4 to 6 pounds a.i. per acre mixed with 40 to 60 gallons of water. In the emulsifiable concentrate formulation, the amended label calls for a single preemergence application at 3 to 6 pounds a.i. per acre mixed with 40 to 60 gallons of water.

The major alternative herbicides registered for preplant or preemergent application on brussels sprouts are trifluralin, DCPA, CDEC, nitralin, and bensulide.

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Extent of Nitrofen Use

Approximately 5,733 acres of brussels sprouts are currently grown in the United States (1977 - 1979 average). About 813 acres (14 percent) were treated with nitrofen prior to its voluntary removal from the market in 1980 (USDA/EPA/States, 1980). Applications were made after transplanting seedings into the field. The amended registration request submitted by Rohm and Haas does not allow nitrofen use on transplanted brussels sprouts.

Currently almost all California brussels sprouts are transplanted and the weed control program for most growers has been to cultivate in a manner to throw dirt in order to bury emerging weeds. The nitrogen assessment team estimated that growers who had been using nitrofen would shift to a weed control program involving cultivations to bury emerging weeds rather than shift a a program involving direct seeding and a preemergence use of nitrofen.

Hence, without any projected use of nitrofen on brussels sprouts, there is no need to conduct an economic analysis of the impact of a loss of pre-emergence nitrofen use.

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SUMMARY OF PRELIMINARY BENEFIT ANALYSIS OF PREEMERGENT NITROFEN USE ON CABBAGE

A. USE:

Nitrofen use on California cabbage

B. MAJOR PESTS CONTROLLED:

annual bluegrass lambaquarters

crabgrass goosefoot

malva pigweed nightshade puralane shepherdspurse spergularia

C. ALTERNATIVES:

Major registered chemicals:

DCPA, CDEC, and trifluralin

Comparative efficacy/performance: Use of alternative weed control methods would maintain current yields and quality in the short run. In the longer run, yields may decline due to anticipated buildup of weed populations.

nettle

Comparative costs:

County	Nitrofen Program Cost/Acre (\$)	Alternative Program Cost/Acre (\$)	Difference in Cost/Acre (\$)
Santa Barbara Monterey Ventura	103-129 103-129 141	190-223 189-221 191-223	87-94 86-92 50-82
Other	159	216	57

D. EXTENT OF USE:

Acres Treated	% of U.S. Cabbage Average	Quantity of Nitrofen Used Annually (1b. a.i.)
4,153	4	8.306

E. ECONOMIC IMPACTS:

User:

The cancellation of nitrofen and the substitution of alternative herbicides for weed control on direct seeded cabbage would result in higher treatment costs for growers. In the short run, the total increase of production costs on the affected acreage in California (8,306 acres) would range from about \$313 to \$331 thousand per year, an increase of about 3 percent in annual production costs.

In the long run the weed population may increase and eventually affect yields and quality of cabbage output.

Market/Consumer:

The use of alternative herbicides in place of nitrofen would have little or no impact on the industry supply or quality of output. Since the affected cabbage acreage represents only 4 percent of total U.S. cabbage output, the increased production costs would be expected to have no significant impact on retail prices.

Macroeconomic:

No significant macroeconomic impact expected.

F. SOCIAL/COMMUNITY IMPACTS:

Alternative weed control programs may require additional field labor. The increased demand for field labor may bid up wages and in some cases cause shortages of field

The use of alternative weed control programs and the reallocation of land to other crops may lead to an increased demand for new farm equipment and other factors of production.

G. LIMITATIONS OF ANALYSIS:

Estimates of comparative efficacy of nitrofen and alternative herbicides were based on the experience of weed science specialists and not on field data.

There are insufficient biological and economic data to assess potential long run impacts of increasing weed pressure following a loss of nitrofen.

H. PRINCIPAL ANALYST AND DATE:

Allen Scheid Economic Analysis Branch Benefits and Field Studies Division Office of Pesticide Programs U.S. Environmental Protection Agency

Shwu-eng Webb Pest Control Branch Natural Resource Economics Division Economic Research Service U.S. Department of Agriculture

July 1981

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Character Labb Star Courter Stones Hotels H. 1962 Emoto 29 01-10100 Hotels H. H. H. B. Herter J.A. Bess Curts at an English Preliminary Benefit Analysis of Nitrofen Use on California Cabbage

Current Use Analysis

EPA Registrations of Nitrofen and Alternatives

Nitrofen is a selective herbicide which was previously registered for preemergent and postemergent use on cabbage for the control of a variety of weeds including: annual bluegrass, crabgrass, goosefoot, lambsquarters, malva, nightshade, nettle, pigweed, purslane, shepherdspurse, and spergularia (EPA, 1980). Under the terms of the amended registration, nitrofen will be applied to cabbage grown only in California on a preemergence basis only. Many of the nitrofen treatments are expected to be in combination with other herbicides such as DCPA, CDEC, or trifluralin. The label directions for nitrofen use in the emulsifiable concentrate formulation (25EC) call for a single preemergence spray at 3 to 6 pounds active ingredient per acre mixed with 40 to 60 gallons of water.

The major alternative herbicides registered for use on cabbage at preemergence are DCPA, CDEC, and trifluralin. The future status of CDEC is uncertain, since the only domestic producer has stopped production of the pesticide. There are, however, sufficient stocks of CDEC on hand for at least one more crop year.

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Extent of Nitrofen Use

About 8,500 acres of cabbage are currently under cultivation in California which accounts for about 9 percent of the total U.S. cabbage acreage (USDA, 1981). Six major cabbage producing counties accounted for nearly 80 percent of California cabbage acreage (Table 1), of which about 4,153 acres were treated with nitrofen. Nitrofen is expected to be applied on direct seeded acres as a band application at 2 pounds of active ingredient (a.i.) per acre. An estimated 10,000 pounds a.i. of nitrofen are expected to be applied to cabbage in California. It was estimated that usage would be about the same as the former nitrofen program.

Economic Impact Analysis

Farm Impacts

Production Cost Changes

The nitrofen weed control program for cabbage would include a preemergence application of nitrofen, frequently in combination with CDEC, DCPA and trifluralin. Hoeing and cultivation would also be used on all acres treated with nitrofen (Nitrofen Assessment Team, 1981). Weed control costs ranged from about \$103 to \$159 per acre (Table 2). These costs usually include four cultivations and hand hoeing to thin and control those weeds which escape chemical control.

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If nitrofen were not available, growers would be expected to substitute alternative programs using trifluralin, DCPA, CDEC, and nonchemical controls (Table 4). In order to compensate for the reduced effectiveness of the alternative herbicides, growers would use additional cultivations and hand hoeings during the growing season (Nitrofen Assessment Team, 1981). In addition, growers would have to increase the seeding rate to insure adequate competition with the emerging weeds and to compensate for the loss of plants during early mechanical and hand hoeing weed control. The seeding cost would increase from \$30 per acre with nitrofen to \$60 per acre without nitrofen (Table 4). The weed control cost of using alternative weed control programs on the affected acreage is estimated to range from \$189 to \$223 per acre (Table 5). The total weed control cost would increase from \$534,700 with nitrofen to \$847,700 without nitrofen but with CDEC.

If both nitrofen and CDEC were not available, weed control costs would range from \$189 to \$223 per acre (Table 5). Total weed control costs would increase to \$866,200 without nitrofen or CDEC (Table 5).

Based on 1980 budget estimates for cabbage grown in California, a \$64 to \$86 increase in costs resulting from the use of alternative weed control programs would represent an increase of about 3 percent in total production costs. This cost increase would represent about 49 percent of estimated net returns (University of California, 1980).

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Yield and Revenue Impacts

The use of alternative weed control programs in the place of nitrofen would have no adverse affect on the quality of the cabbage marketed. Short term output levels would also be maintained if alternative weed control programs were used on the impacted California cabbage acreage. Therefore, the only net revenue impact would be an increase of the production cost of about \$313 to \$331 thousand for the affected areas in California.

In the longer run, it is expected that increased weed pressures would increase the cost of maintaining weed populations at levels that circumvent significant yield or quality losses. Since California produces about 9 percent of total U.S. cabbage and about 49 percent of California cabbage would be treated with nitrofen, it is unlikely that significant production cost increases could be passed on in the market. Therefore, it is likely that some producers would shift to alternative crops.

Consumer Impacts

In the short run, any impact to the consumer would be minor since total production costs are expected to increase by about 3.6 percent on only 4 percent of the total U.S. acreage with no significant yield or quality impacts. In the longer run, it is not clear what the impact of some producers shifting out of cabbage production would be. If other regions of the country could produce the additional cabbage without major cost increases, the impacts would be minor. Nitrofen was used on about 44

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percent of U.S. cabbage prior to its removal from the market by 3c hm and Ilaas. Therefore, it is expected that the proposed program would provide California producers with a cost of production advantage relative to other cabbage producers; the loss of nitrofen would reduce this advantage. It is likely that, over time, a combined loss of nitrofen in California and the rest of the country could result in retail price increases of an undetermined magnitude.

Limitations of Analysis

1. There are insufficient biological and economic data for long run estimates of potential impacts of a possible regulatory action on nitrofen.

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e of Agriculative Acoustic Analysis of Millerton. February.

Table 1. Cabbage acreage and acres treated with nitrofen in California, by county

County	: Acres : planted <u>a</u> /	Direct seeded acres b/	Percent of directed seeded acres treated <u>b</u> /	: Acres : treated
Monterey	2,000	1,000	100	1,000
Ventura	1,800	1,600	90	1,440
Santa Barbara	1,400	1,400	70	980
Imperial	660	528	65	343
Riverside	590	472	65	307
San Diego	320	160	52	83
Total	6,770	5,160	80	4,153

a/ California Crop and Livestock Reporting Services. <u>California Vegetable Crops</u>, Annual Summaries, 1979.

b/ USDA/EPA/States, Nitrofen Assessment Team.

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Description of nitrofen weed control programs for cabbage in California, by county a/ Table 2.

nty: Program :	per				This.		
1-Mitrofen (Pre) 2-Mitrofen (Fre) + DCPA (Pre) 3-Trifluralin(PPI) + Nitrofen (Pre) 4-Mitrofen (Pre) 5-Mitrofen (Pre)		cost per 1b. of a.i.	: Material :: and :: application a/:	:Cultivation: /:	and hoe d/:	Hoe :	Total
, arbara	(lbs a.f.)			Dollars-	S		
arbara	2	7.42	22.84	28.	52.50	0	103.34
3-Trifluralin(PPL) + Nitrofen (Pre) Ventura 4-Nitrofen (Pre) Santa Barbara 5-Nitrofen (Pre)	2 4.5	7.42	48.27	28.	52.50	0	128.77
arbara	0.25	10.07	42.36	28.	52.50	0	122.86
	2	7.42	22.84	28.	52.50	37.50	140.84
	2	7.42	22.84	28.	52.50	0	103.34
6-Nitrofen (Pre) + DCPA (Pre)	2 4 . 5	7.42	48.27	28.	52.50	0	128.77
Imperial, Riverside, and San Diego 7-DCPA (Pre) +Nitrofen (Pre)	4.5	5.65	48.27	21.	52.50	37.50	159.27

Pre - Preemergent application; Post - Postemergent application; PPI - Preplant incorporated.

d/ Hoeing cost is \$7.50 per hour.

a/ Nitrofen Assessment Team, 1981.

Includes both material and application costs. Application cost is \$8 per acre for preemergent or postemergent application as single ingredient or tank-wix, and is \$17 per acre for the preplant incorporated application.) q

c/ Cultivation lost is \$7 per acre each time.

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3ble 3. Total cost of nitrofen weed control programs used on cabbage in California, by county

	:	Weed:	Acres ti	reated b/	:	Cost	:	Total weed
County	:	control :		:	—:	per	:	control
	:	program a/:	Percent	: Acres	:	acre a/	•	cost
						(\$)	<u>·</u>	(\$1,000)
onterey	1-	Nitrofen (Pre)	70	700		103.34		72.3
		Nitrofen (Pre) + DCPA (Pre)	20	200		128.77		25.8
		Trifluralin (PPI) + Nitrofen (Pre)	10	100		122.86		12.3
		Total	100	1,000		110.38		110.4
entura	1-	Nitrofen (Pre)	100	1,440		140.84		202.8
		Total	100	1,440		140.84		202.8
nta Barbara	1-	Nitrofen (Pre)	86	840		103.34		86.8
		Nitrofen (Pre) + DCPA (Pre)	14	140		128.77		18.0
		Total	100	980		106.94		104.8
operial, Riverside, and								
San Diego		OCPA (Pre) HNitrofen (Pre)	100	733		159.27		116.7
		Total	100	733		159.27		116.7

 $[\]frac{a}{b}$ Table 2. Table 1.

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SHORT RUN ECONOMIC ANALYSIS OF PREEMERGENT NITROFEN USE IN CALIFORNIA

United States Department of Agriculture
United States Environmental Protection Agency
Benefits and Field Studies Division
and
University of California

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CONTENTS

I.	SUMMARY AND INTRODUCTION	
	A. SUMMARY B. INTRODUCTION C. SCOPE	I-1 I-5 I-5
II.	SHORT RUN ECONOMIC ANALYSIS OF PREEMERGENT NITROFEN USE IN CALIFORNIA	
	A. BROCCOLI B. BRUSSELS SPROUTS C. CABBAGE D. CAULIFLOWER E. CELERY	II-1 II-16 II-19 II-32 II-48



SUMMARY

If the April 1981 application by Rohm and Haas to amend the registration for nitrofen is denied, increased production costs would reduce short term income for impacted California vegetable producers (Table 1). The loss of income for nitrofen users was estimated under two scenarios with CDEC either available or not available as an alternative control. The total short term income loss for nitrofen users over both scenarios was estimated to range from \$12.39 million (with CDEC available) to \$13.334 million (with CDEC unavailable): \$11 to \$11.8 million for broccoli; \$.313 to \$.331 million for cabbage; \$1.03 to \$1.15 million for cauliflower; and \$.047 to \$.053 million for celery. Farm income losses are not expected for California brussels sprout growers, since little preemergent nitrofen use is anticipated. Non-users of nitrofen may experience windfall economic gains, but data were not available for such estimates.

Approximately 94,000 California acres are expected to be treated annually with 189,000 pounds a.i. nitrofen (Table 1). Base acre treatments and nitrofen usage by different sites are as follows:

Sites	Expected Base Acre Treatments	Percent of California Acres	Percent of U.S. Acres	Expected Pounds A.I. Applied	Expected % of Total Nitrofen Usage
broccoli	71,148	98	91	144,000	76.2
brussels	negligible	less than	less than	negligible	negligible
cabbage	4,153	49	4	8,306	4.4
cauliflower	15,714	48	35	31,428	16.6
celery	2,569	12	7	5,138	2.7
Total	93,584			188,872	100

^{1/} CDEC is no longer being manufactured; existing supplies may last one more year. California is currently reviewing the continued use of CDEC in the state.

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Table 1. Overall Summary of the Short Run Economic Impacts of Presnergent Nitrofen Use in California

	Expected Extent of Use	nt of Use	Percent of			Produce	Producer Income Loss (Gain)	Consumer Economic
Site	Pounts A.I. Applied	Treated	California	Percent of U.S. Acres	Alternative Controls a/	Million Dollars	(Sibrt Kin) Dilars Per Acre	Impact (Short Run)
Broccoli	144,000	71,148	86	16	DXPA, CDEC, trifturalin, cultural methods	\$11-\$11.8 m11tfon	\$155-\$166 (7.3-13.6%)	Higher retail prices anticipated
Brussels Sprouts	little or no use	960 O	N/A	V/V	ICPA, CIEC, triffuralin, cultural methods	None I	N/A	None
Cabbaye	8,306	4,153	67	7	DCPA, QFC, triffuralfn, cultural methods	\$.313-\$.331 million	\$ 86-5 94	No significant
Caulfflower	31,428	15,714	87	3)	UCPA, CDEC, cultural methods	\$1.03-\$1.15 mullion	\$ 65-\$.73	No significant fupact
Gelery	5,138	2,569	12	7	pronetryne, chloroxuron, crop off	\$.047-\$.053	\$ 15-\$ 23 (4%)	No significant impact
All Sites	188,872	93,584	1		1	\$12.39-\$13.334 m1111on	1	,

a/ The alternative herbicides will frequently be used in combination with each other and in control programs which include cultural methods (machinical cultivation, land hosing).

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Preemergent use of nitrofen on California vegetable crops is expected to vary considerably by site. Although nitrofen use on brussels sprout acreage is expected to be negligible, the base acres treated are expected to vary from 12 to 49 percent for celery, cauliflower, and cabbage. At least 98 percent of the California broccoli acreage is expected to be treated with nitrofen.

If the application for the amended registration of nitrofen is denied, the decline in short term income of all impacted California vegetable growers would range from \$12.39 million (with CDEC available) to \$13.334 million (without CDEC available) (Table 1). Longer term income changes or possible economic windfall gains to nonimpacted growers could not be estimated with available data. The ramifications of increases term changes in weed populations shifts in crop production patterns, or the development/availability of alternative controls could not be accurately quantified. However, without a new alternative control, weed populations would be expected to increase and result in cost of production increases beyond those estimated in this report.

Since short term crop output losses are not expected if the request for the amended registration for nitrofen is denied, consumer retail price impacts would be affected primarily by increased crop production costs shifting the market supply functions. Though not quantified, the largest short term retail price increases would be expected for those sites that have both large percentage increases in per acre production costs as well as a large proportion of the U.S. output affected by the nitrofen regulatory decision. Thus, the crops with greatest potential for retail price increases are broccoli and to a lesser extent, cauliflower.

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Longer term consumer price impacts could not be evaluated with existing data. The implications of uncertain increases in weed control costs, possible yield and/or quality losses, shifts in crop production patterns, or the development/availability of alternative controls could not be accurately assessed.

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INTRODUCTION

Rohm and Haas Company submitted an application to EPA on April 17, 1981 for the purpose of amending the registration of nitrofen (TOK®).

Rohm and Haas has requested to limit nitrofen use to the EC25 formulation as a preemergent weed control for the five following California use sites: broccoli, brussels sprouts; cabbage; cauliflower; and celery.

Any nitrofen usage would also be limited to direct seeded cropping schemes and application by firms or individuals under contractual agreement with Rohm and Haas.

For some of the California use sites, a denial of the amended nitrofen registration would be expected to have economic impacts of increasing production costs and thereby reducing growers' income.

However, cost effective control programs are available for some sites; hence, negligible economic impacts would be anticipated in these situations.

This report examines the short run implications of a denial of the amended registration application. Qualitative estimates of the longer run ramifications are provided whenever possible.

SCOPE

The short run impacts of a possible denial of an amended nitrofen registration are the primary objectives of this study. The California nitrofen use sites that were analyzed include: broccoli, brussels sprouts, cabbage, cauliflower, and celery.

The economic analyses focus on the short run changes in growers' income that would result from such an action. Consumer, macroeconomic, and social/community impacts were primarily limited to qualitative assessments.

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on one that primary objectives of this couly. The Confidence is a checker were analyzed include: broweoli, benealth

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The economic impact estimates were derived by the use of partial budgeting techniques. Information on acres treated with nitrofen, alternative weed control input requirements, and comparative evaluations between nitrofen and alternatives were provided by USDA/State biologists; EPA biologists provided the team with information on registered controls, use practices, and use limitations by site. Crop acreage, production, and commodity prices were based mostly on 1980 data.

Economic estimates for the long run were limited to qualitative assessments since information on longer term producer and market adjustments were not readily available.

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entimates the long run were limited to qualitative

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SUMMARY OF PRELIMINARY BENEFIT ANALYSIS OF NITROFEN USE ON BROCCOLI

Nitrofen use on broccoli (California only).

OR PESTS CONTROLLED:

annual bluegrass crabgrass

goosefoot

lambequarters malva nightshade

nettle shepherdspurse pigweed spergularia puralane

ERNATIVES:

jor registered chemicals:

DCPA, CDEC, and trifluralin

n-chemical controls:

Mechanical cultivation and hand hoeing.

aparative efficacy/performance: Use of alternative weed control methods would maintain current yields and quality in the short run. In the longer run, yields may decline due to anticipated cumulative buildup of weed populations.

mparative costs:

Nitrofen Program Cost/Acre (\$)	Alternative Program Cost/Acre (\$)	Difference in Cost/Acre
43-135	232 - 243	155 - 166

Nitrofen program includes use of nitrofen in sequence with DCPA, CDEC, or trifluralin, along with 3 mechanical cultivations and 1 hand hoeing. Alternative programs may include use of 2 herbicides, such as DCPA, CDEC, or trifluralin. Alternative programs also include greater seeding rates and additional mechanical cultivations and hand hoeings.

ENT OF USE:

Acres Treated	% of U.S. Broccoli Acreage	Quantity of Nitrofen Used Annually (lb. a.i.)
71,148	91	144 000

NOMIC IMPACTS:

oducer:

In the short run, the estimated 405 growers currently using nitrofen on broccoli would incur annual production cost increases ranging from about \$11.0 to \$11.8 million. Production costs would increase by about 7 to 13 percent on the affected acreage, or by \$27,000 to \$29,000 annually on the average affected farm of 175 acres.

These cost impacts would reduce grower incomes in the short run. In the long run, the costs would probably be shifted forward in the market since over 90% of U.S. acres will be affected. Some of the impacted growers would be expected to reallocate their land to other crops less affected by a nitrofen regulatory action.

rket/Consumer:

The use of alternative herbicides in place of nitrofen would maintain broccoli availability and quality in the short run. Retail prices would be expected to rise as increased production costs are passed on to consumers. In the longer run, higher grower prices would tend to stimulate new and expanded production which would increase the supply of broccoli and reduce the initial impact on retail prices. However, increased problems with weed competition are expected in future years, which would tend to reduce yields.

TAL/COMMUNITY IMPACTS:

Alternative weed control programs may require additional field labor. The increased demand for field labor may bid up wages and in some cases cause shortages of field labor.

The reallocation of land to other crops may lead to an increased demand for new farm equipment and other factors of production.

ITATIONS OF ANALYSIS:

Estimates of comparative efficacy of nitrofen and alternative herbicides were based on the experience of weed science specialists and not on field data.

NCIPAL ANALYST AND DATE:

Mark Luttner Economic Analysis Branch Benefits and Field Studies Division Office of Pesticide Programs U.S. Environmental Protection Agency

Rob McDowell Pest Control Branch Natural Resource Economics Division Economic Research Service U.S. Department of Agriculture

July, 1981

Preliminary Benefit Analysis of Nitrofen Use on California Broccoli

Current Use Analysis

EPA Registrations of Nitrofen and Alternatives

Nitrofen is a selective herbicide which was previously registered for preemergent and postemergent use on broccoli for the control of a variety of weeds including: annual bluegrass, crabgrass, goosefoot, lambsquarters, malva, nightshade, nettle, pigweed, purslane, shepherdspurse, and spergularia (EPA, 1980). Under the terms of the amended registration, nitrofen will be applied to broccoli grown only in California on a preemergence basis only. Many of the nitrofen treatments are expected to be in combination with other herbicides such as DCPA, CDEC, or trifluralin. The label directions for nitrofen use in the emulsifiable concentrate formulation (25EC) call for a single preemergence spray at 3 to 6 pounds active ingredient per acre mixed with 40 to 60 gallons of water.

The major alternative herbicides registered for use on broccoli at preemergence are DCPA, CDEC, and trifluralin. The future status of CDEC is uncertain, however, since the only domestic producer has stopped production of this pesticide. There are, however, sufficient stocks of CDEC on hand for at least one more crop year.

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Extent of Nitrofen Use

Broccoli represents the most important use for nitrofen, both in terms of annual acreage treated and pounds of active ingredient used. Of approximately 78,450 acres of broccoli currently grown in the United States (1980 acreage) about 72,600 are in California (93%) (U.S. Department of Agriculture, 1981). About 71,148 acres (98 percent) of California's crop are expected to be treated with nitrofen if it is available (Nitrofen Assessment Team, 1981). The acreage likely to be treated in California amounts to about 91% of the total U.S. acreage. A total of about 144,000 pounds active ingredient of nitrofen would be used on broccoli annually under the amended regis—

There are an estimated 405 farms that will use nitrofen on broccoli.

The average farm size is about 175 acres (U.S. Department of Commerce,

1974).

Farm Impacts

Production Cost Changes

The typical nitrofen weed control program for broccoli would include a preemergence application of nitrofen, frequently in combination with other herbicides. On about 91 percent of the treated acreage (about 64,750 acres), nitrofen would be used in combination with hoeing and cultivation to control weeds. On the remaining 10 percent of the acreage (about 6,400 acres) nitrofen would be used in various treatment schedules with CDEC (if available), DCPA, and trifluralin (Nitrofen Assessment Team, 1981).

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The cost of these various nitrofen treatments would range from about \$44 to \$135 per acre (Table 1). In addition to herbicide treatments, the nitrofen weed control program would usually include three mechanical cultivations at a cost of \$7 per acre per cultivation and one hand hoeing operation per season at a cost of \$52.50 per acre (Nitrofen Assessment Team, 1981). The total cost of the nitrofen programs is estimated at \$5.5 million annually or \$77 per average acre (Table 2).

The use of alternative herbicide combinations would provide less effective weed control than herbicide treatments using nitrofen. In order to compensate for the reduced effectiveness of alternative treatments, growers would typically increase the number of hand hoeing operations by 1 or 2 per season (Nitrofen Assessment Team, 1981). Along with these additional field operations, the use of alternative herbicides would usually require growers to increase their seeding rate by about 5 ounces of seed per acre in order to compete with increased weed populations. The increased seeding rates would increase production costs by \$50 per acre (Nitrofen Assessment Team, 1981).

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If nitrofen use on broccoli were cancelled, growers would likely substitute alternative herbicides for nitrofen at preemergence. If CDEC is available, the principal alternative herbicide programs expected to be used include: DCPA and CDEC (on about 40 percent of the impacted acreage), and DCPA alone (on about 20 percent of the impacted acreage). A cultural controls (hoeing and cultivation) program would be used on about 30% of the affected acres. The costs of these alternative programs range from about \$160 to \$191 per acre (Table 3). On an annual basis (for the total 71,148 impacted acres), the use of alternative herbicides (including CDEC) and cultural methods would result in weed control costs of about \$12.95 million or \$182 per average affected acre (Table 4). This represents a total increase of \$7.45 million annually or \$105 per acre over weed control costs with nitrofen.

If CDEC is not available for use on broccoli growers will likely utilize treatment programs involving trifluralin and DCPA (on about 8 percent of the affected acres), DCPA alone (on 61% of the acreage), and a cultural controls (hoeing and cultivation) program (on about 31% of the affected acres). The total cost of these programs is estimated at about \$13.75 million annually or \$193 per average affected acre (Table 5). This represents an increase in weed control costs with nitrofen available of about \$8.26 million annually or \$116 per average affected acre.

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The total increase in broccoli production costs if nitrofen is unavailable would be about \$155 to \$166 per acre (seeding rate cost increases of \$50 plus the increased price of herbicide and cultural weed control treatments of about \$105 (CDEC available) to \$116 (CDEC unavailable) per average acre). Based on 1980 budget estimates for broccoli growers in California (University of California, 1980), the net increase in total production costs would represent an increase of from 7.3 to 13.6 percent on the impacted acreage (the range in impact is based on the ranges in production cost increases of \$155 to \$166 per acre and the total production cost estimates for broccoli which range from \$1220 to \$2137 per acre).

For the average California grower with 175 acres of broccoli, the use of alternative weed controls would increase annual production costs by about \$27,000 to \$29,000. The use of alternative weed controls on all of the impacted acreage (71,148 acres) would increase annual short term production costs by about \$11 to \$11.8 million.

The combined effectiveness of alternative herbicides and increased cultural weed control efforts will result in little or no adverse effects upon broccoli yield or quality if nitrofen is unavailable (Nitrofen Assessment Team, 1981). Since the cost impacts projected here reflect the growers' efforts to maintain current yield/quality levels, the increases in weed control costs would not be offset by revenue gains. Thus net reductions in grower incomes are anticipated, at least in the short run.

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In the long run, the production cost increases could be shifted forward in the marketplace if the supply function for broccoli was affected. This would occur if the production cost effects were widespread among producers and/or if the cost impacts resulted in a reduction in broccoli plantings. Both of these factors are present in this case, since almost all (91%) of the broccoli grown in the U.S. will be treated with nitrofen if it is available and since the projected cost increases are of such a magnitude that some growers would probably plant alternative crops (particularly less labor intensive crops such as sugar beets and dry beans or cauliflower, which requires less weed management than broccoli)(Galt et al., 1981).

Consumer Impacts

In the short run, consumers of broccoli would probably not be noticeably affected by a regulatory action prohibiting usage of nitrofen. Alternative weed controls would maintain current yield and quality levels. Consumer impacts would therefore be limited to price increases resulting from a shifting forward of the production cost increases experienced by broccoli producers. Since almost all domestic production of broccoli would be affected, consumer level prices would be expected to increase to some extent. Some consumers would react to higher broccoli prices by substituting other vegetables for their current broccoli purchases.

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Consumer Impacts

ore sua, consumers of broadels would probably ask in more thy a regulatory applies prohibition using all aitrofes. A controls would maintain current yloth and quality impacts would then form be limited to price increases a shifting forward if the production cost increases by aroccolf producers. Since almost all compatic readerties affected, consumer level prices would be expected and at some consumers would resect to higher truesolf.

Table 4. Description of nitrofen alternative weed control programs for cabbage in California, by county a/

County	: Program	Rate	: Material	:	Cost	per acre		
County		per	: cost per	:Material	:	Thin		
		acre	: lb. of	: and	:Cultivation:	and	: lloe d/:	Total e/
		bs a.i.)	: a.i.	:application	b/: c/ :	hoe d/ :		
	(1	US a.I.)			Dollars			
Monterey	With CDEC							
	1. DCPA (Pre)	4.5	5.65	44.03	28.	52.5	52.50	207.03
	+ CDEC (Pre)	2.0	5.30				22.30	207.03
	2. Trifluralin							
	(PPI)	0.25	10.07	19.52	28.	67.50	52.50	197.52
	3. DCPA (Pre)	4.5	5.65	33.43	28.	67.50	52.50	211.43
	4. No herbicide	-	-	-	28.	78.75	52.50	189.25
	Total							
	N/O CDEC							
	5. DCPA (Pre)	4.5	5.65	33.43	28.	67.50	52.50	211 /2
	6. Trifluralin			00.40	20.	07.50	32.30	211.43
	(PPI)	0.25	10.07	19.52	28.	67.50	57.75	202.77
	No herbicide				28.	105.00	57.75	220.75
	8. Trifluralin					203.00	3, 1, 3	220.73
	(PPI)	0.25	10.07	19.52	28.	67.50	52.50	197.52
	9. No herbicide	-		-	28.	78.75	52.50	189.25
Ventura	With CDEC	•						
	10. CDEC (Pre)	2.0	5.30	18.60	28.	63.75	52.50	192.85
	11. No herbicide	-	-	-	30.	78.85	52.50	191.25
	W/O CDEC							
	12. No herbicide	_	_	_	30.	78.75	52.50	101 25
	13. No herbicide	-	_	_	30.	95.63	67.50	191.25 223.13
						73.03	07.50	223.13
Santa Barbara	W/O CDEC f/							
	14. No herbicide	-	_	-	29.	78.75	52.50	190.25
	15. DCPA (Pre)	4.5	5.65	33.43	28.	78.75	52.50	222.68
Imperial,	W/O CDEC f/							
Riverside, and San Diego	16. DCPA (Pre)	4.5	5.65	33.43	21.	78.75	52.50	215.68
ACT DIESO	to. Der (re)	7.5	5.05	22.43	41.	70.73	32.30	213.08

Pre - Preemergent application; Post - Postemergent application; PPI - Preplant incorporated.

a/ Nitrofen Assessment Team, 1981.

Includes both material and application costs. Application cost is \$8 per acre for preemergent or postemergent application as single ingredient or tank-mix, and is \$17 per acre for the preplant incorporated application.

Cultivation cost is \$7 per acre each time except for the first cultivation under the no herbicide options in Santa Barbara and Ventura Counties. The first cultivation increases to \$8 in Santa Barbara County and \$9 in Ventura

d/ Hoeing cost is \$7.50 per hour.

Includes \$30.00 per acre increased seeding cost to allow for better competition with emerging weeds.

[/] CDEC under either scenario is not expected to be used as an alternative.

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ous normand weading cont to allow for better competition with emorging wavder. Apacted to be used as as nithrostive.

le 5. Total cost of of alternative weed control programs (without nitrofen) on cabbage in California, by county

	•	Weed	:	Acres trea	ted b/	: Weed :	Total weed
County	:	control	:	:		control :	control
	:	program a/	:	Percent:	Acres	: cost/acre a/:	cost
						\$	\$1,000
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erey		With CDEC					
		1. DCPA (Pre)		50	500	207.03	103.5
		+ CDEC (Pre)					
		2. Trifluralin (PPI)		20	200	197.52	39.5
		3. DCPA (Pre)		20	200	211.43	42.3
		4. No herbicide		10	100	189.25	18.9
		Total		100	1,000	204.20	204.2
		W/O CDEC					
		1. DCPA (Pre)		30	300	211.43	63.4
		2. Trifluralin (PPI)		10	100	202.77	20.3
		3. No herbicide		30	300	220.75	66.2
		4. Trifluralin (PPI)		20	200	197.52	39.5
		5. No herbicide		10	100	189.25	18.9
		Total		100	1,000	208.30	208.3
ra		With CDEC					
		1. CDEC (Pre)		33	475	192.85	91.6
		2. No herbicide		67	965	191.25	184.6
		Total		100	1,440	191.81	276.2
		W/O CDEC					
		1. No herbicide		67	965	191.25	184.6
		2. No herbicide		33	475	223.13	106.0
		Total		100	1,440	201.81	290.6
					,		
Barbara		W/O CDEC c/		20	200	100.05	F 2 2
		1. No herbicide		29	280	190.25 222.68	53.3 155.9
		2. DCPA (Pre)		$\frac{71}{100}$	700 980	213.47	209.2
		Total		100	900	213.47	209.2
ial,		W/O CDEC c/					
side, and		1. DCPA (Pre)		100	733 733	215.68 215.68	$\frac{158.1}{158.1}$
Diego		Total		100	772	715 60	1501

Table 4.

Table 1. CDEC under either scenario is not expected to be used as an alternative

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1.881	215.65	5.83	70.1	

Table 6. Estimated economic impact of nitrofen use for weed control on cabbage in California, by county

: Economic : Economic : impact of : impact of : introfen : loss : and CDEC loss	97.9	87.8	104.4	41.4	331.5
: Economic : impact of : CULC : loss	4.1	14.4	0	0	18.5
: Economic : Weed control : Economic : Economic : impact of : impact of : impact of : impact of : introfen or : CDLC : nitrofen : loss : and CDEC : loss : and CDEC	208.3	290.6	209.2	158.1	866.2
	93.8	73.4	104.4	41.4	313.0
: Veed control : cost without : nitrofen but : with CDEC b/	204.2	276.2	209.2	158.1	847.7
Weed control cost with nitrofen a/	110.4	202.8	104.8	116.7	534.7
County	Monterey	Ventura	Santa Barbara	Imperial, Riverside and San Diego	Total

 $\frac{a}{b}$ Table 3.



SUMMARY OF PRELIMINARY BENEFIT ANALYSIS OF PREEMERGENT NITROFEN USE ON CAULIFLOWER

Nitrofen use on cauliflower.

MAJOR PESTS CONTROLLED:

annual bluegrass crabgrass goosefoot

lambsquarters nettle malva nightshade

pigweed purslane shepherdspurse spergularia

ALTERNATIVES:

Major registered chemicals:

DCPA, CDEC and trifluralin

Comparative efficacy/performance: Use of alternative weed control methods would maintain current yields and quality in the short run. In the longer run, yields may decline due to anticipated buildup of weed populations.

Comparative costs:

County	Nitrofen Program Cost/Acre (\$)	Alternative Program Cost/Acre (\$)	Difference in Cost/Acre (\$)
Santa Barbara	156-174	246-262	88-90
Monterey	156-174	202-262	46-88
Other	156	202-228	46-72

EXTENT OF USE:

Acres Treated	% of U.S. Cauliflower Acreage (1980)	Quantity of Nitrofen Used Annually (1b. a.i.)
15,714	35	31, 428

ECONOMIC IMPACTS:

User:

The cancellation of nitrofen and the substitution of alternative herbicides for weed control on direct seeded cauliflower would result in higher treatment costs for growers. In the short run, the total increase of production costs on the affected acreage in California (15,714 acres) would range from about \$1.0 to \$1.1 million per year, an increase of about 3 percent in annual production costs. In the long run the weed population may increase and eventually affect yields and quality of cauliflower output.

Market/Consumer:

The use of alternative herbicides in place of nitrofen would have little or no impact on the industry supply or quality of output. Since the affected cauliflower acreage represents only 35 percent of total U.S. cauliflower output, it is difficult to measure the impact that production cost increases would have on retail prices.

Macroeconomic:

No significant macroeconomic impact expected.

SOCIAL/COMMUNITY IMPACTS:

Alternative weed control programs would require additional field labor. The increased demand for field labor may bid up wages and in some cases cause shortages of field labor.

The use of alternative weed control programs and the reallocation of land to other crops may lead to an increased demand for new farm equipment and other factors of production.

LIMITATIONS OF ANALYSIS:

Estimates of comparative efficacy of nitrofen and alternative herbicides were based on the experience of weed science specialists and not on field data.

There are insufficient biological and economic data to assess potential long run impacts of increasing weed pressure following a loss of nitrofen.

PRINCIPAL ANALYST AND DATE:

Mark Luttner Economic Analysis Branch Benefits and Field Studies Division Office of Pesticide Programs U.S. Environmental Protection Agency Pest Control Branch Natural Resource Economics Division Economic Research Service U.S. Department of Agriculture

July 1981

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Introduction

The U. S. production of cauliflower for processing and fresh market sales is heavily concentrated in California. Between 1978-1981, approximately 33,000 acres were planted annually in California, producing an annual harvest of 3.1 million cwt., 77 percent of the total U. S. production (USDA, 1980). Nitrofen is a selective herbicide previously registered for preemergent and postemergent use on cauliflower to control a variety of weeds including cheeseweed, goosefoot, knotweed, morning glory, nettle, nightshade, pigweed, and purslane.

Under an amended registration, nitrofen use on cauliflower will be limited to preemergent use in California only. The wettable powder formulation previously used will be replaced by the emulsifiable concentrate.

The major alternative herbicides registered for preemergent use are CDEC and DCPA. Several of the nitrofen weed control programs are expected to utilize tank mixes of these materials with nitrofen. The only domestic producer of CDEC has stopped producing this product, making the future status of CDEC uncertain. Sufficient stocks of CDEC are on hand to last at least one more crop year. In the event CDEC becomes unavailable, the weed control programs utilizing it would be replaced by programs using DCPA and/or additional mechanical cultivation and hand hoeing.

Extent of Nitrofen Use and Alternatives

Under the amended registration, only direct-seeded cauliflower would be treated with nitrofen. Of the estimated 26,220 acres of direct-seeded cauliflower grown in seven California counties, 60 percent or about 15,714 acres would be treated with nitrofen (Table 1). Applied at a rate of 2.0 lbs. (a.i.) per acre, a total of

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Table 1. Served and time of the processed and time of pales pales of the served in Collfornia. Served 1878-76., approximatily 13,3,000 for the Collfornia, productor on and all intress of 3.1 for the cost of the

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31,428 lbs. (a.i.) of nitrofen would be used on cauliflower under the amended registration. In 1974, there were 117 farms growing cauliflower in the six counties containing the cauliflower that would be treated with nitrofen (U. S. Department of Commerce, 1974).

Two of the weed control programs using nitrofen also use CDEC or DCPA.

CDEC (plus nitrofen) would be used on 2,700 acres (Table 3). Applied at a rate of 2.0 lbs. (a.i.) per acre, a total of 5,400 lbs. (a.i.) of CDEC would be applied.

DCPA (plus nitrofen) would be used on 6,930 acres (Table 3). Applied at a rate of 4.5 lbs. (a.i.) per acre, a total of 31,185 lbs. (a.i.) of DCPA would be applied.

Thus, the total amount of herbicides applied using the nitrofen programs would be 31,428 lbs. (a.i.) of nitrofen, 5,400 lbs. (a.i.) of CDEC, and 31,185 lbs. (a.i.) of DCPA.

Without nitrofen and with CDEC, 7,796 acres would be treated with CDEC (alone or tank mixed with DCPA) at a rate of 2.0 lbs. (a.i.) per acre, totaling 15,592 lbs. (a.i.) . DCPA, alone or tank mixed with CDEC, would be applied to 10,440 acres at a rate of 4.5 lbs. a.i. per acre, totaling 46,980 lbs. a.i. of DCPA. Weed control programs using no herbicides would be used on 4,858 acres.

Without nitrofen or CDEC, 10,440 acres would be treated with DCPA (Table 3) at a rate of 4.5 lbs. a.i. per acre, totaling 46,980 lbs. a.i. of DCPA. Weed control programs using no herbicides would be used on the remaining 5,274 acres.

Farm Impacts

Production Cost Changes

The three nitrofen weed control programs (Table 2) utilize a preemergent application of nitrofen, either alone or tank mixed with CDEC or DCPA, three to four mechanical cultivations, and hand hoeing. The cost of these treatments range

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nitioned and with MDET 7,750 acres when we resided with MTEG along wed with DCPA) at a rate of 2.0 lbs (a.1.) has acres folially to, we that DCPA) at a rate of 2.0 lbs (a.1.) has acres folially along of tank hined with CTSC, while is applied to 1.0,400 acres of acres of acres for acres, botaling of 10 lbs. d.f. in OCPA. Mach courses acres for acres of acres.

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from \$155.84 to \$174.26 per acre. The use of the three treatments is dictated by local weed conditions, thus the area treated with each program varies by county (Appendix Table 1). The total cost of the nitrofen programs is estimated at \$2.6 million annually (Table 3), or an average of \$165 per treated acre.

The alternative preemergent herbicides CDEC and DCPA do not control weeds as effectively as nitrofen. Substituting these herbicides for nitrofen requires an additional cultivation and/or additional hand hoeing (thin-hoeing the newly emerged cauliflower stand and hoeing the established cauliflower for weeds) to achieve the same degree of weed control provided by the nitrofen programs. The necessary increases in thin-hoeing and weed hoeing range from 25-100 percent, depending upon the weed infestations and the substitute herbicide(s) (Table 3). In addition to the extra cultivation and hoeing, the use of alternative weed control programs would require growers to increase the seeding rate by three ounces per acre to provide the plant population necessary to successfully compete with the increased weed populations. This increased seeding rate would increase planting costs by \$30.00 per acre (Nitrofen Assessment Team, 1981).

The weed control programs that would be used if nitrofen were not available and CDEC were available range in cost from \$202.38 to \$246.40 per acre (Table 3). The use of these programs varies by county (Appendix Table 1) but for California as a whole, about 3 percent of the acreage would be treated with CDEC alone, 47 percent with CDEC + DCPA, 19 percent with DCPA alone, and 31 percent with no herbicides (Table 3). The total cost of the programs without nitrofen and with CDEC would be \$3.6 million (Table 3), or an average of \$230 per acre. The additional cost of these programs (compared to the nitrofen alternatives) totals \$1.03 million (Table 3), or an average of \$65 per acre. These additional costs include the \$30 per acre extra seed cost.

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to hotel close, suc 3) percent with to herbicking (Table 3). The

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The weed control programs that would be used if nitrofen and CDEC were not available range in cost from \$202.38 to \$262.05 per acre (Tables 2 and 3). While the use of these alternatives varies by county (Appendix Table 1), for California as a whole about 66 percent of the affected acreage would be treated with one of the DCPA programs (programs 6 and 7, Table 2) and 44 percent would be treated with programs using no herbicide (Table 3). The total cost of the programs without nitrofen or CDEC is estimated at \$3.7 million (Table 3), or an average of \$237 per acre. The additional costs of using these alternatives (compared to the nitrofen alternatives) is estimated at \$1.15 million (Table 3), or an average of \$73 per acre.

The total variable costs and total costs of producing fresh market cauliflower in Monterey County, California was estimated at \$2,650 per acre and \$3,190 per acre, respectively, in 1980 (University of California, 1980). The additional costs of the alternatives without nitrofen and with CDEC (an average of \$65/acre) represent an increase of 2 percent in total variable costs. The \$73 per acre average increase in weed control costs for the alternatives without nitrofen or CDEC (compared to the nitrofen alternatives) represents a 3 percent increase in total variable costs. Compared to estimated total cauliflower production costs of \$3,190 per acre, the additional weed control costs represent an increase of 2 percent in total costs without nitrofen and with CDEC, and an increase of 2 percent in total costs without nitrofen or CDEC.

User Impact, By County

The treated acres and weed control programs used vary substantially by county (Appendix Table 1). The costs of various alternatives also vary substantially (Table 2). Hence, the user impact, a function of these variables, also varies substantially by county.

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The total cost of the nitrofen weed control programs is estimated to be \$1.3 million on 7,650 acres in Monterey County, \$0.7 million on 4,320 acres in Santa Barbara County, and \$0.6 million on 3,744 acres in Orange, San Diego, Santa Cruz, and Ventura Counties (Appendix Table 5).

Without nitrofen and with CDEC, the total cost of the weed control programs is estimated at \$1.8 million and \$1.1 million, for Monterey and Santa Barbara counties respectively and \$0.8 million for Orange, San Diego, Santa Cruz, and Ventura Counties. Compared to the nitrofen alternatives, the change in weed control costs is \$482,000 (\$63/acre) in Monterey County, \$367,000 (\$84/acre) in Santa Barbara County, and \$183,000 (\$49/acre) in Orange, San Diego, Santa Cruz, and Ventura Counties. Thus, the average per acre impact in Santa Barbara County is 1.7 times than greater in Orange, San Diego, Santa Cruz, and Ventura Counties, and 1.3 times the impact in Monterey County.

Without nitrofen or CDEC the total cost of weed control programs is estimated at \$1.8 million for Monterey County, \$1.1 million for Santa Barbara County, and \$0.8 million for Orange, San Diego, Santa Cruz, and Ventura Counties. Compared to the nitrofen alternatives, the change in weed control costs is \$530,000 (\$69/acre) in Monterey County, \$435,000 (\$101/acre) in Santa Barbara County, and \$186,000 (\$50/acre) in Orange, San Diego, Santa Cruz, and Ventura Counties. Thus, the per acre user impact in Santa Barbara is: 1) twice the per acre impact in Orange, San Diego, Santa Cruz, and Ventura Counties, and 2) 1.4 times the per acre impact in Monterey County.

Revenue Impacts

In the short run the use of alternative herbicides and/or additional cultural weed control methods is expected to provide weed control equivalent to that achieved with the nitrofen weed control programs. No adverse effects on cauliflower yields or

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beds is expect to provide seed control equivalent at their solutived.

quality are expected to accompany the use of weed control programs not utilizing nitrofen (Nitrofen Assessment Team). Thus, no changes in gross grower revenues are expected.

Net Grower Impacts

Since revenues are not expected to change due to using alternate weed control programs, the short run impact will be a reduction in net income equivalent to the increased weed control costs, assuming ceteris paribus conditions. If production costs in the long run can be passed forward in the marketplace, affected growers may maintain current cauliflower acreage. Shifts to other crops may occur, depending on the relative profitability of other crops. In the longer run weed populations are expected to increase. These increases would be expected to increase weed control costs and could have yield and/or quality impacts. Data were not available to estimate the magnitude of these longer term impacts.

Consumer Impacts

In the absence of expected changes in grower gross revenues; no significant consumer impacts can be expected in the short run. Consumer impacts could not be estimated for the longer run, since the magnitude of increased weed control costs and possible yield or quality losses were not available.

Limitations of Analysis

- 1. The analysis assumes sufficient labor for the additional hand hoeing and mechanical cultivations will be available.
- 2. The analysis assumes all costs and returns will remain constant in the short-run.
- 3. The analysis relies heavily on expert opinion rather than published research results or pesticide use survey results.

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Cauliflower production in California by county; area planted and estimated area treated with nitrofen preemergent, 1980Table 1.

Acres treated with nltrofen $b/$	0	7,650	936	432	4,320	936	1,440	15,714	
Percent direct seeded acres treated with nitrofen $\overline{b}/$	0	50	06	06	80	06	06	09	
Direct seeded acres $\frac{b}{}$	1,360	15,300	1,040	480	5,400	1,040	1,600	26,220	
$1980 \frac{a}{a}$	1,700	18,000	1,300	009	000*9	1,300	2,000	30,900	
County	Central Valley	Monterey	Orange	∃ San Diego	Santa Barbara	Santa Cruz	Ventura	Total	

California Vegetable Crops Annual Summary, 1980. California Crop and Livestock Reporting Service. a/

b/ USDA/EPA/States Nitrofen Assessment Team 1981.

a/ Description of weed control programs used on direct seeded cauliflower grown in California Table 2.

No. (1bs a.i.)	Pro	Program :	Rate : acre :	Material cost per lb. (a.i.)	Cost per acre Material : Thin + : + + : + + : + + : + + : + : + + : + + : + + : + + : + + : + + : + + : + + : + + : + + : + + + : + + + : + + + : + + + + : + + + + : +	Cost p	1 1	: : : Hoe <u>d</u> /	Total e/
Nitrofen 2 7.42 22.84 28.00 52.50 52.50 Nitrofen + CDEC 2 + 2 7.42 + 5.30 33.44 21.00 52.50 52.50 Nitrofen + DCPA 2 + 4.5 7.42 + 5.65 48.26 21.00 52.50 52.50 CDEC 2 5.30 18.60 28.00 78.75 65.63 5 CDEC + DCPA 2 + 4.5 5.30 + 5.65 33.42 28.00 78.75 65.63 5 DCPA II 4.5 5.65 33.42 28.00 78.75 65.63 2 No herbicide II - - - 28.00 78.75 65.63 2 No herbicide II - - - 28.00 78.75 65.63 2 No herbicide II - - - 28.00 105.00 65.63 2	No.				dollars -		1		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Nitrofen + CDEC 2 + 2 7.42 + 5.30 33.44 21.00 52.50 52.50 Nitrofen + DCPA 2 + 4.5 7.42 + 5.65 48.26 21.00 52.50 52.50 CDEC 2 5.30 18.60 28.00 78.75 65.63 DCPA I 4.5 5.65 33.42 28.00 78.75 65.63 No herbicide I - - - 28.00 78.75 65.63 No herbicide II - - - 28.00 78.75 65.63 No herbicide II - - - 28.00 105.00 65.63	•	Nitrofen	2	7.42	22.84	28.00	52.50	52,50	155.84
Nitrofen + DCPA 2 + 4.5 7.42 + 5.65 48.26 21.00 52.50 52.50 CDEC 2 5.30 18.60 28.00 78.75 65.63 5.65 CDEC + DCPA I 4.5 5.65 33.42 28.00 78.75 65.63 5.65 DCPA II 4.5 5.65 33.42 28.00 105.00 65.63 5.63 No herbicide II - - - - 28.00 105.00 65.63 2 No herbicide II - - - - 28.00 105.00 65.63 2	2.	Nitrofen + CDEC		7.42 + 5.30	33.44	21.00	52.50	52.50	159.44
CDEC 2 5.30 18.60 28.00 78.75 65.63 CDEC + DCPA I 2 + 4.5 5.30 + 5.65 44.02 28.00 78.75 65.63 DCPA II 4.5 5.65 33.42 28.00 78.75 65.63 No herbicide II - - - 28.00 78.75 65.63 No herbicide II - - - 28.00 105.00 65.63	3.	Nitrofen + DCPA	2 + 4.5	7.42 + 5.65	48.26	21,00	52.50	52,50	174.26
CDEC + DCPA 2 + 4.5 5.30 + 5.65 44.02 28.00 78.75 65.63 DCPA I 4.5 5.65 33.42 28.00 78.75 65.63 DCPA II 4.5 5.65 33.42 28.00 105.00 65.63 No herbicide I - - 28.00 78.75 65.63 No herbicide II - - 28.00 105.00 65.63	4.	CDEC	2	5,30	. 18.60	28.00	78.75	65.63	220.98
DCPA I 4.5 5.65 33.42 28.00 78.75 65.63 DCPA II 4.5 5.65 33.42 28.00 105.00 65.63 No herbicide II - - 28.00 78.75 65.63 No herbicide II - - 28.00 105.00 65.63	5.	CDEC + DCPA	2 + 4.5	5.30 + 5.65	44.02	28.00	78.75	65.63	246.40
DCPA II 4.5 5.65 33.42 28.00 105.00 65.63 No herbicide II - - 28.00 78.75 65.63 No herbicide II - - 28.00 105.00 65.63	.9	DCPA I	4.5	5,65	33.42	28.00	78.75	65.63	235.80
No herbicide I 28.00 78.75 65.63 No herbicide II 28.00 105.00 65.63	7.	DCPA II	4.5	5,65	33.42	28.00	105.00	65.63	262.05
No herbicide II 28.00 105.00 65.63	· ·	No herbicide I	ı	1	I	28.00	78.75	65.63	202.38
	9.	No herbicide II	ı	1	1	28.00	105.00	65.63	228.63

Includes Monterey, Orange, San Diego, Santa Barbara, Santa Cruz, and Ventura Counties.

b/ Includes an application cost of \$8.00 per acre.

c/ Mechanical cultivation at \$7.00 per acre per cultivation.

d/ Thin-hoeing and hoeing at \$7.50 per hour.

additional seed cost. The lack of preemergent use of nitrofen results in heavier weed infestations requiring The cost of weed control programs that do not utilize nitrofen (programs 4-9) include \$30.00 per acre for additional seed at planting time to insure an adequate stand. e/

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Table 3. Acres treated, cost per acre, and total costs of weed control programs used on direct seeded cauliflower in California $\underline{a}/$

Weed contro	1 program	Cost per acre <u>b</u> /	: Acres treated <u>c</u> /	: : Total cost
With nitrofen		(\$1.00)		(\$1,000)
1 N	itrofen	155.84	6,084	948
2 N	itrofen + CDEC	159.44	2,700	430
3 N	itrofen + DCPA	174.26	6,930	1,208
Total				
Without nitro with CDEC	fen and		15,714	2,586
4 C	DEC	220.98	416	92
5 C	DEC + DCPA	246.40	7,380	1,818
6 D	CPA I	235.80	3,060	722
8 N	o herbicide I	202.38	4,858	983
Total			15,714	3,615
Without nitro	fen			
6 D	CPA I	235.80	3,060	722
7 00	CPA II	262.05	7,380	1,934
8 N	o herbicide I	202.38	4,858	983
9 N	o herbicide II	228.63	416	95
Total			15,714	3,734
Change in con	trol costs			
Without nitrofen and with CDEC		-	-	1,029
Without nitrofen or CDEC		-	-	1,148

Includes Monterey, Orange, San Diego, Santa Barbara, Santa Cruz, and Ventura Counties.

b/ Table 2.

c/ USDA/EPA/States Nitrofen Assessment Team 1981.

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Californio, 1981, Microfen Assessment Teams

appendix Table 1. Acres of direct seeded cauliflower treated with various weed control programs under three regulatory options in California, by county.

County	Regulatory : option :	Treatment <u>a</u> /	Percent of direct seeded acres treated b/	: Acres : treated :
Monterey	With nitrofen	1 3	10 40	1,530 6,120
	Without nitrofen and with CDEC	5 6 8	20 20 10	3,060 3,060 1,530
	Without nitrofen or CDEC	6 7 8	20 20 10	3,060 3,060 1,530
Santa Barbara	With nitrofen	1 2 3	15 50 15	810 2,700 810
	Without nitrofen and with CDEC	5	80	4,320
	Without nitrofen or CDEC	7	80	4,320
Tange, San Diego, Santa	With nitrofen	1	90	3,744
Cruz, Ventura	Without nitrofen and with CDEC	4 8	10 80	416 3,328
	Without nitrofen or CDEC	8 9	80 10	3,328 416

a/ Table 2.
b/ Nitrofen Assessment Team, 1981.
c/ Percentage of direct seed acreage times direct seeded acres in county. Direct seeded acres by county: Monterey - 15,300 acres; Santa Barbara - 5,400 acres; Orange, San Diego, Santa Cruz, Ventura Counties - 4,160 acres (Table 1).

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e times diseas seeded acrea is county. Dimes; ser y - 15,400 acres; Sance Barbata - 1,400 acres; s. Venrusa Counties - 4,160 acres (Table 1),

Appendix Table 2. Acres treated, cost per acre, and total costs of weed control programs used on cauliflower in Monterey County, California

Weed control program	Cost per acre <u>a</u> /	Acres treated <u>b</u> /	: Total cost
	(\$)		(\$1,000)
With nitrofen			
1 - nitrofen 3 - nitrofen + DCPA	155.84 174.26	1,530 6,120	238 1,066
Total		7,650	1,304
Without nitrofen, with CDEC			
5 - CDEC + DCPA 6 - DCPA I 8 - Cult I	246.40 235.80 202.38	3,060 3,060 1,530	754 722 310
Total		7,650	1,786
Without nitrofen or CDEC			
6 - DCPA I 7 - DCPA II 8 - Cult I	235.80 262.05 202.38	3,060 3,060 1,530	722 802 310
Total		7,650	1,834

a/ Table 2, column 7.

b/ Nitrofen Assessment Team, 1981.

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Appendix Table 3. Acres treated, cost per acre, and total costs of weed control programs used on cauliflower in Santa Barbara County, California

Weed control program	:	Cost per acre <u>a</u> /	:	Acres treated <u>b</u> /	Total cost	
		(\$)			(\$1,000)	
With nitrofen						
1 - nitrofen 2 - nitrofen + 3 - nitrofen +		155.84 159.44 174.26		810 2,700 810	126 430 141	
Total				4,320	697	
Without mitrofen, w	vith CDEC					
5 - CDEC + DCPA	7	246.40		4,320	1,064	
Without nitrofen or	CDEC					
7 - DCPA II		262.05		4,320	1,132	

a/ Table 2, column 7. b/ Nitrofen Assessment Team, 1981.

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68.5 02.6 20.5 20.5		. 010 2,708 815 4,320	155.84 158.45 774.25
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Appendix Table 4. Acres treated, cost per acre, and total costs of weed control programs used on California cauliflower in Ventura, Orange, Santa Cruz, and San Diego Counties, California

Weed control program	: Cost	: per : Acres : treated	: Total cost
	(\$)	•	(\$1,000)
ith nitrofen			
1 - nitrofen	155.	3,744	583
ithout nitrofen, w	rith CDEC		
4 - CDEC	220.	98 416	92
8 - Cult I	202.	3,328	674
Total		3,744	766
ithout nitrofen or	CDEC		
8 - Cult I	202.	3,328	674
9 - Cult II	228.	63 416	95
Total		3,744	769

 $[\]frac{a}{b}$ Table 2, column 7. Nitrofen Assessment Team, 1981.

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Acres Trusted, and com acre, and total cours of wood courts. programs used to California zenitflower to Venture, Sunna, Banta Caux, and for these Counties, California

Total cher	Acres : :		
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		Total	Total cost of weed control programs	rol proorams	Cla	Changes in treatment costs	eatment	costs
County :	Treated	:: Programs	Programs without	Programs without : Programs without:	M	ut .	: With	Without
••	acres	: with :	: nitrofen, with	: nitrofen or	: nitrofan,	fan,	: nit:	nitrofen
••		: nitrofen :	: CDEC	: CDEC	: with CDEC	CDEC	: or (or CDEC
••		••		••	:Per acre	Total	: Per ad	: Per acre Total
			(\$1,000)		S.	(\$1,000)	<i>৻</i> ৽	(\$1,000)
Monterey a/	7,650	1,304	1,786	1,834	63	482	69	530
Santa Barbara $\frac{b}{}$ 4,320	4,320	169	1,064	1,132	85	367	101	435
Orange, Ventura, San Diego, Santa Cruz c/	3,744	. 583	766	769	649	183	50	186
Total	15,714	2,584	3,616	3,735	99	1,032	73	1,151

a/ Appendix Table 2. b/ Appendix Table 3. c/ Appendix Table 4.



Preliminary Benefit Analysis of Preemergent Nitrofen Use
on California Celery

Current Use Analysis

EPA Registrations of Nitrofen and Alternatives

Nitrofen, formulated as an emulsifiable concentrate (25 percent active ingredient) is currently registered for preemergent use on celery to control a variety of weeds including: annual bluegrass, crabgrass, goosefoot, lambsquarters, malva, nightshade, nettle, pigweed, purslane, shepherdspurse, and spergularia (USDA/EPA/States, 1980).

Rohm and Haas is currently proposing to amend the TOK E-25® (nitrofen 25 EC) registration and resume marketing in California under the provisions of an amended label and a restrictive contract with its distributor/applicator customers. Under the amended label, nitrofen 25 EC would be registered for preemergent use on direct seeded celery in California. The label would call for a single preemergent spray (after seeding), at the rate of 1 1/2 to 3 gallons (3 to 6 pounds a.i. per acre) (USDA/EPA/States, 1980).

The major alternative herbicides registered for weed control on California celery are prometryne, chloroxuron, and trifluralin (USDA/EPA/States, 1980).

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SUMMARY OF PRELIMINARY BENEFIT ANALYSIS OF PREEMERGENT NITROPEN USE ON CALIFORNIA CELERY

Nitrofen use on California celery.

MAJOR PESTS CONTROLLED:

annual bluegrass crabgrass

gooscfoot

lambsquarters malva nightshade

nettle pigweed Duralane shepherdspurse spergularia

5,138

STERNATIVES:

USE:

Major registered chemicals:

prometryne, chloroxuron, and trifluralin

Comparative efficacy/performance:

Use of alternative weed control methods would maintain current yields and quality in the short run. In the longer run, yields may decline due to enticipated buildup of weed populations.

Comparative costs:

County	Nitrofen Program Cost/Acre (\$)	Alternative Program Cost/Acre (\$)	Difference in Cost/Acre (\$)
Santa Barbara	172-190	191-209	19
Monterey	172-190	187-213	15-23
Acres Treated	Z of California	Z of U.S. Celery	Quantity of Nitrofen
	Acreage (1980)	Acreage (1980)	Used Annually (1b. a.i.)
2,569	12	7	5 138

INTENT OF USE:

ECONOMIC IMPACTS:

User:

The cancellation of nitrofen and the substitution of alternative herbicides for weed control on direct seeded celery would result in higher treatment costs for growers. The use of alternative herbicides would increase annual production costs by about \$19 per acre in Santa Barbara County and \$15 to \$23 per acre in Monterey County. In the short run, the total increase of production costs on the affected acreage in California (2,569 acres) would range from about \$47 to \$53 thousand per year, an increase of less than 1 percent in annual production costs. For the average size grower with 136 to 146 acres of celery, the use of alternative weed controls would increase annual production costs by about \$2,400 to \$3,100.

In the long run the weed population may increase and eventually affect yields and quality of celery output.

The use of alternative herbicides in place of nitrofen would have little or no impact on the industry supply or quality of output. Since the affected celery acreage represents only 7 percent of total U.S. celery output, the increased production costs would be expected to have no significant impact on retail prices in the short run. In the long run, the increasing weed population in the impacted areas could eventually reduce celery output and/or quality and cause upward pressure on retail prices.

Macroeconomic:

Market/Consumer:

No significant macroeconomic impact expected.

SOCIAL/COMMUNITY IMPACTS:

Alternative weed control programs may require additional field labor. The increased demand for field labor may bid up wages and in some cases cause shortages of field labor.

The use of alternative weed control programs and the reallocation of land to other crops may lead to an increased demand for new farm equipment and other factors of production.

UNITATIONS OF ANALYSIS:

Estimates of comparative efficacy of nitrofen and alternative herbicides were based on the experience of weed science specialists and not on field data.

There are insufficient biological and economic data to assess potential long run impacts of increasing weed pressure following a mitrofen suspension.

RINCIPAL ANALYST AND DATE:

Allen Scheid Economic Analysis Branch Benefits and Field Studies Division Office of Pesticide Programs U.S. Environmental Protection Agency Shwu-eng Webb Pest Control Branch Natural Resource Economics Division Economic Research Service U.S. Department of Agriculture

July 1981

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Extent of Nitrofen Use

Of approximately 3,950 acres of direct seeded celery grown in California during 1980, an estimated 2,569 acres (12 percent of the total California acreage and 7 percent of the total U.S. acreage) are expected to be treated with nitrofen 25 EC if it is available for use. The typical method of applying nitrofen to the celery acreage would be by means of band sprays, at the rate of 2 pounds active ingredient per acre (Nitrofen Assessment Team, 1981). (The suggested label rate for broadcast sprays is 3 to 6 pounds active ingredient per acre.)

Assuming that nitrofen is applied by means of band sprays, the total amount of nitrofen applied to California celery each year would be about 5,138 pounds active ingredient (Nitrofen Assessment Team, 1981).

Nearly all of the treated acreage would be located in Monterey and Santa Barbara Counties where the average acreage for celery farms are 136 and 146 acres respectively (U.S. Department of Commerce, 1977).

Farm Impacts

Production Cost Changes

The typical nitrofen weed control programs for California celery would include a preemergent band application of nitrofen and prometryne as well as a postemergent application of either prometryne or chloroxuron mixed with oil. In addition to herbicide treatments, these programs would be expected to include four mechanical cultivations, one thinning/hoeing operation, and one weed hoeing operation per season.

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Production Cost Changes

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The per acre costs of the nitrofen programs are estimated to be about \$172 to \$190 (Table 1). Since an estimated 1,125 and 1,144 acres of celery would be treated with nitrofen in the counties of Santa Barbara and Monterey respectively, the total cost of the nitrofen programs would range from about \$442 to \$488 thousand per season (Table 2).

If nitrofen use on direct seeded celery were denied, growers would likely substitute alternative herbicides and/or additional field operations. In Santa Barbara County, the affected growers would be expected to use prometryne at preemergence as well as prometryne or chloroxuron mixed with oil at postemergence on all of the 1,125 impacted acres. Since the use of these herbicides without nitrofen would be expected to provide less effective weed control, it was estimated that the time required for thinning/hoeing would increase by about 3.5 hours per acre (Nitrofen Assessment Team, 1981). The total costs for the alternative weed control programs in Santa Barbara County were estimated to be about \$191 to \$209 per acre (Table 3), an increase of about \$19 per acre over the cost of the nitrofen program.

In Monterey County, the alternative weed control programs would include the use of prometryne and/or chloroxuron along with increased field labor for thinning and weed hoeing operations (Table 4). The costs of these programs would range from about \$187 to \$213 per acre, an increase of about \$15 to \$23 per acre over the cost of the nitrofen programs.

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The total cost of the alternative weed control programs in Monterey and Santa Barbara counties would be about \$495 to \$535 thousand per season (Table 5), an increase of about \$47 to \$53 thousand over the estimated cost of the nitrofen programs. The overall cost increase per impacted acre would average about \$18 to \$21 per season. For the average size grower with 136 to 146 acres of celery, the use of alternative weed controls would increase annual production costs by about \$2400 to \$3100.

Based on the 1981 preliminary budget estimates for growing direct seeded celery in Santa Barbara (University of California, 1981), this average increase in weed control costs resulting from the use of alternative pesticides would represent an increase of less than one percent in overall production costs. In the short run, the use of alternative herbicides and increased cultural weed control efforts would be expected to result in little or no adverse impacts on celery yields or quality if nitrofen is unavailable (Nitrofen Assessment Team, 1981).

Although a denial of nitrofen use is expected to have no significant impact on yields or quality of ouput in the short run, the use of less effective alternative herbicides may result in a gradual increase of weed pressure in certain areas. Specific weeds, such as malva, shepherdspurse and spergularia, which are not effectively controlled by alternative herbicides may become especially troublesome for celery growers in the long run. Increasing weed pressure may eventually have significant impacts on yields and/or quality of celery

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output. In some severely impacted areas, growers may switch from direct seeded to transplanted celery. Others may eventually decide to reallocate their celery acreage to other agricultural uses less affected by the growing weed population. The lack of biological data prevents a quantitative estimate of these potential long run impacts.

Consumer Impacts

In the short run, consumers of celery would not be significantly affected by the denial of nitrofen use. Alternative weed controls would maintain current crop yield and quality levels. Since the impacted acreage represents only about 12 percent of California's total celery acreage (7 percent of the U.S. celery acreage), it is likely that impacted growers would absorb most or all of their production cost increases rather than pass them on to consumers in the form of higher prices.

In the long run, the increasing weed population in the impacted areas could eventually reduce celery output and/or quality and cause some upward pressure on retail prices. Current biological information is insufficient to estimate the extent of these potential long run impacts on celery consumers.

Social/Community Impact

The additional hoeing operations required by alternative weed control programs would increase the seasonal demand for field labor and

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Sogt 1/Community Impact

and possibly bid up current wages. In some areas there could be seasonal shortages of field labor.

The use of alternative weed control programs or the reallocation of land to other crops could lead to an increased demand for new farm equipment and other factors of production.

Limitations of Analysis

- 1. There are insufficient biological and economic data for long run estimates of potential crop shifts following a nitrofen suspension.
- 2. This analysis assumes that adequate supplies of labor for additional hoeing operations and mechanical cultivations are available for the alternative weed control programs used on celery.
- 3. The price of field labor is assumed to remain constant in the short run, at \$7.50 per hour.
- 4. The future availability of chloroxuron is uncertain since domestic producers have recently terminated production. At present, there appears to be sufficient stocks of chloroxuron on hand for at least one more year of use.

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evallability of chlorouscod is uncertain. these demonstrates the best second, there is been to be cultically the stocks of chlorouscon on head for at least the of use.

5. The suspension of nitrofen is expected to have a cumulative impact on future celery crops over the next couple of years as potential increases in weed populations may affect output. Current data limitations prevent a quantitative assessment of the long run impacts.

2. AT 1879 DIET EIN BANK COUPLE OF YEARS AS POLEBALL

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Per Acre Costs of Preemengent Mitrofen Wead Control Programs for Direct Seeded Celery in Santa Barbara and Monterey Counties of California Table 1.

A Control cogram (Application Rate (Lbs. A.I.)	Cost Per Lb. Herbic of A.1. 1/ Cos (\$)	Nerbicide + Application Cost Per Acre 2/ (\$)	Oultivation Cost Per Acre $\frac{3}{2}$ (\$)	Thin Hoeing Cost Per Acre 4/ (\$)	Weed Hoeing Cost Per Acre 5/ (\$)	Total Costs Per Acre (\$)
E. nitrofen + prametryne 2 + 1	2 + 1	7.42 + 7.95	30.79				
t E. pronetryne	1	7.95	15.95				
			46.74	28.00	52.50	45.00	172.24
E. nitrofen + prometryne 2 + 1	2 + 1	7.42 + 7.95	30.79				
t E. chloroxuron +	1+1 (gal.)	1 + 1 (gal.) 7.00 + 18.70/gal.	33.70				
			64.49	28.00	52.50	45.00	189.99

The latest nitrofen prices available were for 1980, prior to the voluntary removal of nitrofen from the market by Rohm and Maas. Prices for the alternative pesticides are for 1981.

Includes herbicide cost plus an application cost of \$8.00 per acre.

4 cultivations per season at \$7.00 per acre per time.

Hand hoeing operation used to thin out crop plants, 7 hours of field labor per acre at \$7.50 per hour.

Hand hoeing operation used to reduce weeds, 6 hours of field labor per acre at \$7.50 per hour.

irces: Nitrofen Assessment Team, 1981.

Table 2. Total Cost of Presnergent Nitrofen Weed Control Programs for Direct Seeded Celery in Santa Barbara and Monterey Counties of California

County	Weed Control. Program	Cost Per Acre $\frac{1}{4}$ (\$)	Number of Acres Treated	Total Cost (\$)
Santa Barbara	nitrofen (pre) + prometryne (pre) + prometryne or chloroxaron + crop oil (post)	172.24 - 189.99	1,125	193,770 - 213,739
Monterey	nitrofen (pre) + prametryne (pre) + prametryne or chloraxuron + crop oil (post)	172.24 - 189.99	1,444	248,715 - 274,346

 $\frac{1}{2}$ See Table 1.

Sources: Mitrofen Assessment Team, 1981.

Per Acre Costs of Alternative Wead Control Programs for Direct Sealed Celery in Santa Barbara County of California Table 3.

Weed Ibeing Total Costs Cost Per Acre 4/ Per Acre (\$)			52.50 191.15			52.50 208.90	
Thin ibeing Weed ibeing Obst Per Acre 4/(\$)			78.75			78.75	
Oultivation Obst Per Acre $\frac{2}{}$ (\$)			28.00			28.00	
Herbicide + Applicaton Oost Per Acre 1/ (\$)	15.95	15.95	31.90	15.95	11. 33.70	49.65	
Cost Per Ib. of A.I. (\$)	7.95	7.95		7.95	7.00 + 18.70/gal.		
Application Rate (lbs. A.I.)	1	1		1	1+1 (gal.)		
eed Control Program	re E. pronetryne	ost E. pronetryne	11-5	ere E. prometryne	re E. chloroxuron +		

Includes herbicide cost plus an application cost of \$8.00 per acre.
4 cultivations per season at \$7.00 per acre per time.

Hand hoeing operation used to thin out plants, 10.5 hours of field labor per acre at \$7.50 per hour. Hand hoeing operation used to reduce weeds, 7 hours of field labor per acre at \$7.50 per hour.

Sources: Nitrofen Assessment Team, 1981.

Table 4. Per Acre Costs of Alternative Weed Control Programs for Direct Seeded Celery in Monterey County of California

Wecd Control Program	Application Rate (Lbs. A.I.)	Cost Per Lb. Herbi of A.I. C	Herbicide + Applicaton Cost Per Acre <u>1</u> / (\$)	Cultivation Cost Per Acre 2/ (\$)	Thin Hoeing Cost Per Acre 3/ (\$)	Weed Hoeing Cost Per Acre 4/ (\$)	Total Costs Per Acre (\$)
Pre E. prometryne + chloroxuron 1 + 1	oxuron 1+1	7.95 + 7.00	22.95				
Post E. chloroxuron + crop oil 1 + 1 (gal.) 7.00 + 18.70/gal.	p oil 1+1 (gal.)	7.00 + 18.70/gal.	33.70				
			26.65	28.00	67.50 5/	52.50	204.65
Pre E. prometryne + chloroxuron 1 + 1	oxuron 1+1	7.95 + 7.00	22.95				
Post E. prametryne		7.95	15.95				
TT-'			38.90	28.00	67.50 5/	52.50	186.90
Pre E. prometryne	1	7.95	15.95				
Post E. chloroxuron + crop oil	op oil 1+1 (gal.)	7.00 + 18.70/gal.	33.70				
			49.65	28.00	78.75 6/	52.50	208.90
Pre E. prometryne	1	7.95	15.95				
Post E. prometryne	П	7.95	15.95				
			31.90	28.00	78.75 6/	52.50	191.15
Pre E. pronetryne	H	7.95	15.95	28.00	78.75 6/	77 00.06	212.70
1/ Tollide botholde	ost nius an applicat	Traindes berhiefde cost plus an amplication cost of \$8.00 per acre-	ere.				

Includes herbicide cost plus an application cost of \$8.00 per acre-4 cultivations per season at \$7.00 per acre per time.

land toeing operation used to thin out crop plants. Except where noted, the operation requires 9 hours of field labor per acre at \$7.50 per hour. Except where noted, the operation requires 7 hours of field labor per acre at \$7.50 per hour. land hoeing operation used to reduce weeds. न्। लिला की की की

^{10.5} hours of field labor at \$7.50 per lour. 9 hours of field labor at \$7.50 per hour.

¹² hours of field labor at \$7.50 per hour.

Sources: See Table 1.

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Table 5. Total Cost of Alternative Weed Control Programs for Direct Seeded Celery in Sunta Barbara and Ponterey Counties of California

	<u> </u>	75	6	-1	9
Total Cost (\$)	215,044 - 235,013	134,942 - 147,757	76,651 - 83,769	68,277	494,914 - 534,816
Number of Acres Treated	1,125	722	401	321	2,569
Cost Per Acre 1/ (\$)	191.15 - 208.90	186.90 - 204.65	191.15 - 208.90	212.70	
Weed Control Program <u>1/</u>	Santa Barbara prometryne (pre) prumetryne or chloroxuron + crop oll (post)	prometryne (pre) + chloraminan (pre) 186.90 - 204.65 prometryne or chloraminan + crop oil (post)	<pre>prometryne (pre) prometryne or chlorukuron + crop oil (post)</pre>	prometryne (pre)	Total
County	Santa Barbara	Monterey			

 $\underline{1}$ See Tables 3 and 4.

Sources: Nitrofen Assessment Team, 1981.

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